UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/763,059	01/22/2004	Yoshihiko Kuroki	S1459.70077US00	3714

7590 03/05/2009

Randy J. Pritzker
Wolf, Greenfield & Sacks, P.C.
600 Atlantic Avenue
Boston, MA 02210

EXAMINER	
CHEN, CHIA WEI A	

ART UNIT	PAPER NUMBER
2622	

MAIL DATE	DELIVERY MODE
03/05/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/763,059	KUROKI ET AL.	
	Examiner	Art Unit	
	CHIA-WEI A. CHEN	2622	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 December 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10,21 and 37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10,21 and 37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on December 23, 2008 has been entered.

Response to Arguments

2. Applicant's arguments filed Dec. 23, 2008 have been fully considered but they are not persuasive.

Applicant argues with respect to claim 1 that MacAulay does not teach or suggest a three-dimensional image pickup apparatus wherein recorded light intensities represent different images received by said light receiving elements at different incoming angles of light and at different times, so that a three-dimensional image including the different images is provided when the recorded light intensities are reproduced. Applicant asserts that MacAulay contains no teaching as to how the light impinging on individual pixels in combined, compiled, and/or reconstructed to provide a 3D image of the sample, and further asserts that a skilled person reviewing MacAulay would obtain no teaching of a three-dimensional image pickup apparatus wherein

recorded light intensities represent different images received by the light receiving elements at different incoming angles of light and at different times, so that a 3D image including the different images is provided when the recorded light intensities are reproduced.

However, the Examiner respectfully disagrees. MacAulay clearly teaches wherein a three-dimensional image pickup apparatus records light intensities representing different images at different times for creating three-dimensional images in col. 24, lines 18-39. In this section of the patent, MacAulay discloses time-delayed snapshots of dynamic objects. MacAulay discloses a similar function in col. 23, lines 58-67. Furthermore, a video image is simply a collection of a time-series of still images. MacAulay discloses the ability to capture consecutive still images in the above-cited passages.

MacAulay also discloses the construction of a 3D image by taking into account the recorded individual pixels and corresponding angles and calculated via computer-implemented programming to topographically reconstruct a three dimensional image of an object (col. 7, lines 60-col. 8, line 1).

Applicant argues with respect to claims 10 and 37 that MacAulay contains no disclosure or suggestion of a three-dimensional image pickup apparatus wherein intensity information and corresponding incoming angle information of acquired light are recorded in a coordinated relationship with each other, the recorded intensity information representing different images received by the light intensity acquisition

means at different incoming angles and at different times, wherein a three-dimensional image including the different images is provided when the recorded intensity information is reproduced.

However, the Examiner respectfully disagrees. MacAulay clearly teaches wherein a three-dimensional image pickup apparatus records light intensities representing different images at different times for creating three-dimensional images in col. 24, lines 18-39. In this section of the patent, MacAulay discloses time-delayed snapshots of dynamic objects. MacAulay discloses a similar function in col. 23, lines 58-67. Furthermore, a video image is simply a collection of a time-series of still images. MacAulay discloses the ability to capture consecutive still images in the above-cited passages.

MacAulay also discloses the construction of a 3D image by taking into account the recorded individual pixels and corresponding angles and calculated via computer-implemented programming to topographically reconstruct a three dimensional image of an object (col. 7, lines 60-col. 8, line 1).

Applicant argues with respect to claim 21 that Holzbach in view of MacAulay does not disclose or suggest a three-dimensional image pickup apparatus wherein intensities of light received by the light receiving elements and corresponding different incoming angles of light selected by the light path selection elements at different times are coordinated with each other to form video signals that represent different images

received by the light receiving elements at different incoming angles of light and at different times.

However, the Examiner respectfully disagrees. MacAulay clearly teaches wherein a three-dimensional image pickup apparatus records light intensities representing different images at different times for creating three-dimensional images in col. 24, lines 18-39. In this section of the patent, MacAulay discloses time-delayed snapshots of dynamic objects. MacAulay discloses a similar function in col. 23, lines 58-67. Furthermore, a video image is simply a collection of a time-series of still images. MacAulay discloses the ability to capture consecutive still images in the above-cited passages.

MacAulay also discloses the construction of a 3D image by taking into account the recorded individual pixels and corresponding angles and calculated via computer-implemented programming to topographically reconstruct a three dimensional image of an object (col. 7, lines 60-col. 8, line 1).

Applicant further agues that MacAulay does not disclose or suggest a light emitting section including light emitting elements which emit light based on video signals to produce a three-dimensional image including different images at corresponding different outgoing angles of light and at different times, as required by amended claim 21.

Examiner acknowledges that MacAulay does not disclose a light emitting section including light emitting elements which emit light based on video signal. However, the Holzbach reference is used to teach this limitation in col. 9, lines 9-15 and in col. 5, lines

13-17. The combination of Holzbach in view of MacAulay teaches the elements of claim 21.

Thus, the rejections of claims 1, 10, 21, and 37 and subsequent dependent claims are sustained.

Claim Rejections - 35 USC § 102

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 1-5, 8, 10, and 37 are rejected under 35 U.S.C. 102(b) as being anticipated by MacAulay (US 6,483,641).

Claim 1, MacAulay teaches a three-dimensional image pickup apparatus in Fig. 3, comprising:

- a plurality of light receiving elements for receiving and converting light into an electric signal (light detector 26 that comprises an array of individual detection pixels; col. 17, lines 46-50); and
- a plurality of light path selection elements for selecting different incoming angles of light to come to said light receiving elements at different times (spatial light modulator, e.g. digital micromirror device 34; col. 16, line 62-col. 17, line 9);

- said light receiving elements and said light path selection elements being arranged such that a plurality of pixels formed from said light receiving elements and said light path selection elements are disposed both in a row direction and a column direction (detection array and SLM array are aligned with each other; col. 17, lines 55-58, Fig. 4;
- intensities of the light received by said light receiving elements and the corresponding different incoming angles of light selected by said light path selection elements at different times being recorded in a coordinated relationship for the individual pixels, the recorded light intensities representing different image received by said light receiving elements at different incoming angles of light and at different times, wherein a three- dimensional image including the different images is provided when the recorded light intensities are reproduced (Controller compiles data obtained from the detector to reconstruct images. This would require the recording of the coordinated relationships of the angles of the SLMs and the intensity of light received by the light detector; col. 16, lines 10-12, col. 22, lines 40-57; col. 7, lines 60-col. 8, line 1; col. 23, lines 58-67; col. 24, lines 18-39).

Claim 2, MacAulay teaches a three-dimensional image pickup apparatus according to claim 1, wherein each of the pixels is formed from one of said light receiving elements and one of said light path selection elements which are paired with each other (col. 17, lines 55-58).

Claim 3, MacAulay teaches a three-dimensional image pickup apparatus according to claim 1, wherein the incoming angle of light selected by each of said light path selection elements varies as time passes (col. 22, lines 40-47).

Claim 4, MacAulay teaches a three-dimensional image pickup apparatus according to claim 1, wherein each of said light path selection elements is a reflecting element which drives a reflecting plate for reflecting light to select the incoming angle of light which comes to one of said light receiving elements so that the light of the incoming angle is light reflected by the reflecting plate (SLM may be a digital micromirror device that reflects light to the image plane 40; col. 16, lines 39-46).

Claim 5, MacAulay teaches a three-dimensional image pickup apparatus according to claim 4, wherein said reflecting element is a mirror plate, a Micro-Electro-Mechanical Systems element or a digital micromirror device (trade name) driven by a piezoelectric element (col. 16, lines 39-46).

Claim 8, MacAulay teaches a three-dimensional image pickup apparatus according to claim 1, wherein said light path selection elements are liquid crystal waveguides disposed in front of light receiving faces of said light receiving elements and selectively vary the refractive index of liquid crystal filled in said waveguides to select transmission paths of light (SLM can be an array of ferroelectric liquid crystal device; col. 15, line 27).

Claim 10, MacAulay teaches a three-dimensional image pickup apparatus, comprising:

- light intensity acquisition means for acquiring intensity information of received light (intensity of the light impinging on individual pixels in the detection array can be detected; col. 22, lines 44-45); and
- incoming angle acquisition means for acquiring corresponding incoming angle information of the received light at different incoming angles and at different times (controller varies the orientation of the SLM and illuminates the object from a plurality of angles; col. 22, lines 40-45, col. 16, line 62-col. 17, line 9); the
- intensity information and the corresponding incoming angle information of the light being recorded in a coordinated relationship with each other the recorded intensity information representing different images received by said light intensity acquisition means at different incoming angles and at different times, wherein a three-dimensional image including the different images is provided when the recorded intensity information is reproduced (It is inherent that the intensity information and the incoming information be recorded in a coordinated relationship with each other in order to be reconstructed as an 3-D image of the sample; col. 22, lines 45-50; col. 7, lines 60-col. 8, line 1; col. 23, lines 58-67; col. 24, lines 18-39).

Claim 37 is analyzed as an information recording method of the apparatus of claim 10.

Claim Rejections - 35 USC § 103

5. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over MacAulay (US 6,483,641) in view of Moranski (US 6,094,289).

Claim 6, MacAulay teaches a three-dimensional image pickup apparatus according to claim 1, but does not teach wherein said light path selection elements are driving members which carry and drive said light receiving elements to vary the directions in which light receiving faces of said light receiving elements are directed.

Moranski teaches driving members which carry and drive said light receiving elements to vary the directions in which light receiving faces of said light receiving elements are directed (photodetector 216 disposed on a free end of a cantilever beam; col. 13, lines 14-23).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the driving member of Moranski with the apparatus of MacAualay in order to avoid a movable structure that is susceptible to mechanical fatigue and failure. The cantilever beam is a solid state device which has extremely high reliability. (See col. 2, lines 1-15 of Moranski.)

7. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over MacAulay (US 6,483,641) in view of Sun (US 6,415,068).

Claim 7, MacAulay teaches a three-dimensional image pickup apparatus according to claim 1, but does not teach wherein said light path selection elements are lenses disposed in front of light receiving faces of said light receiving elements and drive said lenses to vary relative positions of said lenses to said light receiving elements.

Sun teaches wherein said light path selection elements are lenses disposed in front of light receiving faces of said light receiving elements and drive said lenses to vary relative positions of said lenses to said light receiving elements (col. 3, line 66-col. 4, line 7; col. 6, lines 10-16).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the microlenses of Sun with the apparatus of MacAulay since the microlens switching assembly provides a fast switching of signals and a small required driving force.

8. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over MacAulay (US 6,483,641) in view of Hosoi (US 6,400,490).

Claim 9, MacAulay teaches a three-dimensional image pickup apparatus according to claim 1, but does not teach wherein said light path selection elements are Mach-Zehnder elements disposed in front of light receiving faces of said light receiving

elements and each selectively varies the refractive index of a phase control section provided in a light path to cause interference of light to select transmission paths of light.

Hosoi teaches wherein said light path selection elements are Mach-Zehnder elements (12).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the Mach-Zehnder waveguides of Hosoi with the apparatus of MacAulay since the Mach-Zehnder optical modulator is stable with respect to disturbance and can obtain modulation characteristics featuring excellent signal-to-noise ratio. (See col. 1, lines 15-25 of Hosoi.)

9. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Holzbach (US 6,795,241) in view of MacAulay (US 6,483,641).

Claim 21, Holzbach teaches a three-dimensional image pickup and display apparatus in Fig. 14, comprising:

- a light reception section (detector element 172) including a plurality of light receiving elements for receiving and converting light into an electric signal and
- said light receiving elements and said first light path selection elements being arranged such that a plurality of pixels formed from said light receiving elements and said first light path selection elements are disposed both in a row direction and a column direction (col. 10, line 47),

- a light emission section (LED) including a plurality of light emitting elements for emitting light in accordance with an electric signal and a
- plurality of second light path selection elements (light modulator DMD) for selecting corresponding different outgoing angles of light to be emitted from said light emitting elements at different times (col. 10, lines 47-62),
- said light emitting elements and said second light path selection elements being arranged such that a plurality of pixels formed from said light emitting elements and said second light path selection elements are disposed both in a row direction and a column direction (col. 9, lines 9-15),
- said light emitting elements emitting light in accordance with a coordinated relationship between the corresponding different outgoing angles of light selected by said second light path selection elements at different times and the intensities of light for the individual pixels based on the video signals to produce a three-dimensional image including the different images at the corresponding different outgoing angles of light and at different times (control both light intensity and light directions; col. 5, lines 13-17);

but does not expressly teach:

- a plurality of first light path selection elements for selecting different incoming angles of light to come to said light receiving elements at different times,
- intensities of the light received by said light receiving elements and the corresponding different incoming angles of light selected by said first light path selection elements at different times being coordinated with each other for the

individual pixels to form video signals that represent different images received by said light receiving elements at different incoming angles of light and at different times.

MacAulay teaches

- a plurality of first light path selection elements for selecting different incoming angles of light to come to said light receiving elements at different times (spatial light modulator, e.g. digital micromirror device 34, col. 16, line 62-col. 17, line 9), and
- intensities of the light received by said light receiving elements and the corresponding different incoming angles of light selected by said first light path selection elements at different times being coordinated with each other for the individual pixels to form video signals that represent different images received by said light receiving elements at different incoming angles of light and at different times (Controller compiles data obtained from the detector to reconstruct images. This would require the recording of the coordinated relationships of the angles of the SLMs and the intensity of light received by the light detector; col. 16, lines 10-12, col. 16, line 62-col. 17, line 9, col. 22, lines 40-57).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the light path selection elements of MacAulay with the apparatus of Holzbach to provide a significant advantage in controlling the angle of illumination, quantity of light, and the location of light reaching the detector. (See col. 2, lines 54-64 of MacAulay.)

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHIA-WEI A. CHEN whose telephone number is (571)270-1707. The examiner can normally be reached on Monday - Friday, 7:30 - 17:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lin Ye can be reached on (571) 272-7372. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Tuan V Ho/
Primary Examiner, Art Unit 2622

/Chia-Wei A Chen/
Examiner, Art Unit 2622